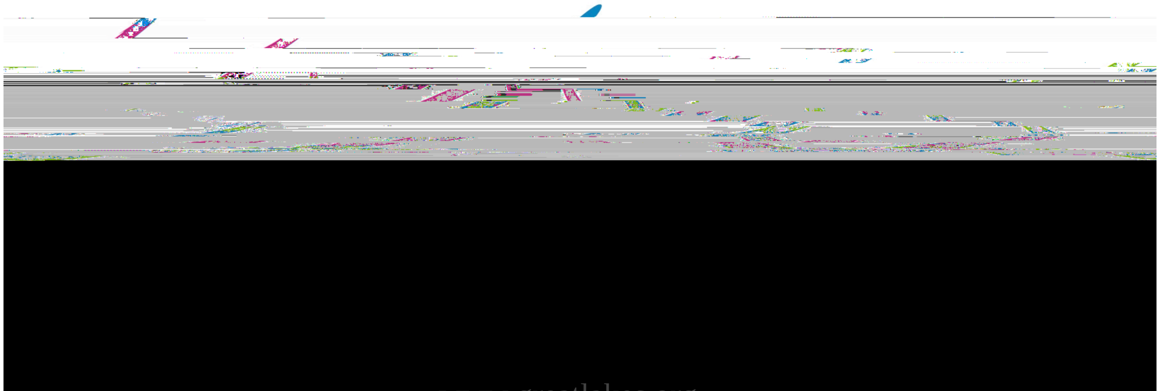

www.greatlakes.org

Protecting Public Health, Caring for Chicago's Waters

An Agenda for Action

Photo courtesy of Laura Barghusen, Openlands: Recreators enjoy canoeing and fishing in the Little Calumet River.

Table of Contents

Acknowledgements

The Alliance for the Great Lakes would like to thank the consortium of organizations and individual experts that contributed so consistently to the creation of this report, from co-authoring and editing the document, to research and technical analysis, this report truly represents a joint effort. But beyond this, the report symbolizes a common vision and mission for the Chicago Area Waterways System among key stakeholders. Jonah Smith, project manager with the Alliance, is the primary coordinator of this report, with significant assistance from Jim Filippini and Dale Bryson.

We also extend our gratitude to USEPA, IEPA, the City of Chicago, and MWRD, in their willingness to work with us in these efforts, now and into the future.

We would finally like to acknowledge the personnel and staff in the offices of the Illinois Attorney General, the Lieutenant Governor, and the Governor, in their support of these important public health and economic improvement measures.

A special thank you goes out to the Chicago Community Trust, who made this report possible through their generous funding.

Primary Organizational Report Contributors (in alphabetical order):
Alliance for the Great Lakes
Environmental Law & Policy Center
Natural Resources Defense Council
Prairie Rivers Network
Sierra Club

Executive Summary

A century ago water in the Chicago area was valued as much for its ability to send waste elsewhere as it was a necessary ingredient for life. Lake Michigan was a place to stay away from, especially after heavy rains swept offal from the Chicago River into the lake. Later, through the construction of the Sanitary and Ship Canal, the Chicago River was diverted to send pollution to the Des Plaines, Illinois and Mississippi rivers. Still later, the North Shore Channel and the Cal Sag Canal were built to help move even more of Chicago's wastewater towards the Mississippi.

Today, some 65 million visits to Chicago's lakefront annually help make our coast significant to the region's economy, recreation, and quality of life. But also, with improved water quality, increasingly people are attracted to the Chicago River, the North Shore Channel, the Cal Sag and other portions of the Chicago Area Waterway System (CAWS) despite the fences, signs and warnings to keep them away. With its river sight-seeing, gondolas, and fishing sites, the Chicago River and other components of the CAWS have joined Lake Michigan as pillars of what makes the city a global attraction.

In 2005 over 11,500 paddlers rented canoes to use on the CAWS[1]. Countless others used the CAWS for other forms of recreation. Yet Chicago continues to be one of the few major cities across the U.S. that does not disinfect its wastewater effluent. What needs to be remembered is that the region's waters belong to all of us, and that we have an obligation to protect these uses that have only increased and flourished over recent decades.

For far too long we have looked at many stretches of the CAWS as places to avoid, rather than as places to fish, paddle and congregate.

That is the old way of looking at our waters and it needs to change.

We can attempt unsuccessfully to shield public health by keeping people away from the waters they love, or we can realize that this tactic is a relic of the old way of viewing the river and lakefront. Ultimately, we can no more shield public health by keeping people from their waterways than we can try to keep our children healthy by p0 we can 0pused the CAWS significantly contributing to the economy. We need to ensure that our laws and water quality standards are working to protect public health, integrating commercial and recreational uses to implement that vision, and to protect these precious natural treasures. Mayor Richard Daley understands this vision, and that is why he calls for disinfection of CAWS in his 2005 *Chicago River Agenda*.

* * * * *

To help protect public health we need to improve CAWS water quality. Two key components of improvement include disinfecting the sewage discharges from the Metropolitan Water Reclamation District's massive sewage treatment plants, and significantly reducing polluted overflows from the sewer system.

Ill-treated, our waters can threaten public health. Nurtured, they can bolster it. The purpose of this report is to provide a prescription for caring for the CAWS. The CAWS consists of 78 miles of water, including:

(1) North Segment: North Shore Channel, North Branch of the Chicago River, Chicago River, South Branch of the Chicago River, South Fork of the South Branch;

(2) South Segment: Calumet River, Grand Calumet River, Little Calumet River, Lake Calumet and Cal-Sag Channel; and

(3) Middle Segment: Chicago Sanitary & Ship Canal (CSSC)

Recommendations Abstract

The major sources of wastewater to CAWS, which adversely impact the full usage of the waterway, are overflows from combined sewers and discharges from three main wastewater treatment plants (WWTP) of the Metropolitan Water Reclamation District of Greater Chicago (MWRD). While MWRD and the City of Chicago work to complete adequate control of combined sewer overflows (CSOs) over the next several years, this report recommends that appropriate agencies take two immediate steps to promote public health and water quality *now*:

- Designate all stretches of CAWS for full "fishable/swimmable" uses as required by the Clean Water Act (CWA). Commendably, the Illinois Environmental Protection Agency (IEPA) has proposed strengthening water quality standards to secondary contact (boating and limited contact with the water) for the North and South Segments. However:

    - IEPA must redo its proposal to strengthen the water quality standards for CAWS by designating <u>all</u> of the waterways for full uses-fishable/swimmable, based on the current uses and the attainable uses in each segment of CAWS, and to fully support that proposal before the Illinois Pollution Control Board (IPCB). The effective date for the new standards should be March 1, 2010, with implementation of those standards to begin immediately at the North Side and Calumet sewage treatment plants.

    - While the Middle Segment does not receive as much public use as do the North and South Segments, current uses and attainable uses still dictate the stronger standards for <u>all</u> segments. Failing to designate the Middle Segment for full uses is inconsistent with protecting public health, and will mean that water quality in that segment will likely continue to be treated as industrial and domestic waste conduits consistent with the old purpose of that segment for years, if not decades, to come. Such a policy would be inconsistent with the law and intent of the CWA, as well as the Use Attainability Analysis (UAA) process, which stipulates that our nation's waterways must be reviewed every three years in order to update water quality standards that are consistent with present and attainable uses. However, attainment of these standards will occur over time and the timetable for attainment of fishable/swimmable standards in the CSSC might be scheduled for as late as 2012.

    - The Illinois Pollution Control Board must adopt the upgraded water quality standards to make them fully effective for CAWS, so that they are protective of fishable/swimmable uses.

- The MWRD must commit to disinfecting the wastewater from its three main wastewater treatment plants that discharge into CAWS.

- In 2007, the Chicago metropolitan area's wastewater treatment agency, the MWRD, is one of the only major agencies in the U.S. that does not disinfect much of its wastewater effluent,[2] where whole or partial body contact is a present or attainable use. This includes its three largest plants that discharge to the CAWS—among them the largest sewage treatment plant in the world.

- A number of disinfection technologies are available, including the use of ultraviolet (UV) light, ozone, and chlorination/de-chlorination.

- The use of one of the most increasingly preferred disinfection technologies, UV, is available at a relatively low cost of $8.52 per person per year for the greater Chicago metropolitan area (based on the MWRD's population-served density number of 5.4 million).

- To substantially reduce CSOs in CAWS, MWRD and its service communayunioist

- The City must continue to work with the MWRD on controlling CSOs that will eventually be discharged into TARP.

* * * * *

More and more, people are calling for MWRD to disinfect its wastewater. Many members of the IEPA's Stakeholder Advisory Committee (SAC) have consistently called for disinfection as a result of the findings of the USEPA required UAA study. Additionally, Chicago Mayor Richard M. Daley's 2005 *Chicago River Agenda* called on MWRD "to implement cost-effective disinfection technologies that improve the recreational potential of the river while limiting negative impacts on the environment." Still, some MWRD officials continue to adhere to the old vision of CAWS as a waste conduit, essentially dismissing the UAA process by refusing to disinfect: "the District will not be disinfecting the effluents from the North Side and Calumet Water Reclamation Plants."[4]

Protecting public health and advancing the new vision for our waterways is not a new idea. Nor are the actions or technologies needed to help advance that vision uncommon. In fact, they have been implemented in metropolitan areas with fewer resources than the Chicago metro region for years. In short, if they can do it, we in the Chicago metropolitan area can do it.

Background

Chicago's lakefront and the Chicago River have changed and continue to change over time. A glimpse at our relationship with the waters of the past shows a steady trajectory towards improved water quality and public uses in the future.

A. Historical Setting

The irony of the Chicago River is that to protect water quality in Lake Michigan, we have chosen to harm the river. For much of the last two centuries our use of CAWS has endangered public health. We reversed the river's flow away from the lake to protect our drinking water, yet failed to properly control pollution that goes into a river that we recreate on, eat fish from, and sometimes release back into Lake Michigan.

Before European settlement, the Chicago River was a slow, shallow, meandering stream that drained marshes, woodlands, and prairies into Lake Michigan. After Europeans settled in the area, they dredged and straightened the river into channels for agricultural drainage and expedited stormwater runoff in the north. They also built seawalls to accommodate commercial shipping on the lower reaches. Yet the sewerage system at that time was primitive. Wastes initially flowed out into the streets, then later through underground pipes, but it all eventually discharged either directly into Lake Michigan or into the Chicago River, which then discharged into the lake.

Throughout much of the 1800s waterborne diseases frequently created states of emergency for Chicago. Giant rainstorms washed the pathogenic wastewater of the Chicago River far out into Lake Michigan, the budding city's drinking water source. Although the water intake cribs were moved farther out into the lake away from the wastes, this did not prevent polluted wastewater from reaching the cribs and negatively impacting public health. As a result, early Chicago's population was plagued by typhoid fever, cholera and dysentery, significantly attributable to wastewater contamination. In 1854 for example, 5.5 percent of the population died from a cholera epidemic[5]. Between 1860 and 1900, typhoid fever took the lives of on average, 65 individuals per 100,000 people per year. The worst of these years was in 1891, when the typhoid death rate was 174 per 100,000 persons. (Chicago Municipal Reference Library, 1997).

Such incidents killed and sickened tens of thousands of people. In 1889, the Sanitary District of Chicago (SDC), which later became the MWRD, was created to protect drinking water supplies and improve the river's deplorable condition. The SDC began working to reverse the flow of the river so that sewage would move away from Lake Michigan, thereby sending wastewater downstream to the Illinois and Mississippi rivers.

---

[5] It should be noted that while it is not specifically cited here, there is a controversy surrounding whether 90,000 people died in the region in 1885 from a cholera epidemic, as asserted by Libby Hill in her 2000 (Lake Claremont Press) book, "*The Chicago River: A Natural and Unnatural History," which gained some wide acceptance.*

The project finished in 1900, and the depth of the new flow supported barge traffic on the artificially created Chicago Sanitary and Ship Canal (CSSC)—so named for its two primary uses. In 1910, SDC completed the North Shore Channel to drain sewage effluent away from Lake Michigan into the North Branch of the Chicago River and ultimately to the CSSC (MWRD website).

E. Upgrading of Standards are Required by Law

Two of the principal goals of the Clean Water Act are to:

• Restore and maintain the chemical, physical and biological integrity of the Nation's waters; and

• Where attainable, achieve water quality that promotes protection and propagation of fish, shellfish, and wildlife, and provides for recreation in and on the water. This goal is commonly known by the expression of achieving "fishable/swimmable" waters, and was supposed to be achieved by July 1, 1983. National policy further called for programs to be developed and implemented "in an expeditious manner" (CWA: Section 101 (a) (7)).

These goals are accomplished by setting water quality standards for all bodies of water (for a more detailed discussion on water quality standards, see Appendix B). A water quality standard consists of two major elements: (1) the designated beneficial use or uses of a waterbody or segment of a waterbody; and (2) the water quality criteria necessary to protect the use or uses of that particular waterbody.

Commonly used use designations include the following: drinking water; water-based recreation including primary contact (swimming, water-skiing, and other activities likely to result in immersion) and secondary contact recreation (boating, wading and rowing and other activities when immersion is unlikely); fishing; aquatic life protection for various types of warm water species including protecting their habitat; agriculture water supply; and industrial water supply. USEPA does not recognize waste transport as an acceptable use.

Water quality criteria describe the quality of water that will support each designated beneficial use. Water quality criteria are levels of individual pollutants or water quality characteristics, that, if met, will generally protect the designated use of the water. For a given designated use, there are likely to be a number of criteria dealing with different types of conditions, as well as levels of specific chemicals and other pollutant parameters (e.g. temperature). Since most waterbodies have multiple designated uses, the number of water quality criteria applicable to a given waterbody can be very substantial.

Water quality criteria may be expressed as numeric limits or as a narrative standard. An example of a water quality criterion is a dissolved oxygen level of 5 milligrams per liter to support a warm water fishery. Water quality criteria must be scientifically consistent with attainment of designated uses. This means that only scientific considerations can be taken into account when determining what water quality conditions are consistent with meeting a given designated use. Economic and social impacts are not considered relevant when developing water quality criteria.

Once such standards based on such uses have been established, pollution discharge limits in pollution discharge permits must meet those standards and uses. With public uses of CAWS intensifying, the UAA must change the Chicago River system's "designated uses". With upgraded uses must come stronger water quality standards, including bacteria limits, for CAWS.

To accomplish a new vision for the CAWS, designated uses should be upgraded. Such designations must take into account how the river system is used today, but more importantly, how it can be used in the future.

preamble to the Water Quality Standards Regulation, which states: "even though it may not make sense to encourage use of a stream for swimming because of the flow, depth or the velocity of the water, the States and USEPA must recognize that swimming and/or wading may occur anyway. In order to protect public health, States must set criteria to reflect recreational uses if it appears that recreation will in fact occur in the stream". The regulations also state: "Where existing water quality standards specify designated uses less than those which are presently being attained, the State shall revise its standards to reflect the uses actually being attained" (emphasis added). "States must adopt those water improvements for the region demands we recognize this trend, not discourage or hide from it.[10]

Moreover, there are promising signs of accepting this new vision of the waterways everywhere, including the thousands of canoe rentals that are logged each season, the revitalization of river park development all over Chicago, and the 400 plus launches last year from a previously closed launch site on the Chicago Sanitary and Ship Canal. The river has the ability to integrate industrial and recreational uses, as an intact, vital natural resource for the community.

This was recently demonstrated by the MWRD lease of property which enabled the Village of Summit in 2005 to reopen a boat launch just downstream from the Stickney WWTP. Several types of watercraft are launched there each year throughout the months of May-October.[11] The lease is an encouraging sign that MWRD understands the future of CAWS should be directed toward responsible human use and to its credit, MWRD is beginning to foster that use.

The Illinois EPA (IEPA) is nearing completion of a UAA of CAWS to re-evaluate its uses (see Appendix B for a more complete discussion of the requirements of a UAA and its relationship to establishing water quality standards). Under the CWA, a "Triennial Review" process for water quality standards was to be implemented to ensure that the waterbody's uses and attainable uses are consistent and current. Initiated decades after the requirement, the CAWS \4 cent, t 22 that the

Milwaukee, when in 1993 an outbreak of Cryptosporidiosis[13] resulted in an estimated 400,000 cases of acute gastroenteritis and 100 deaths, and represents the largest documented case of disease associated with contamination of drinking water in the United States.

Many other types of waterborne outbreaks undoubtedly occur each year but remain unrecognized or unreported. For instance, an estimated 20,000-30,000 cases of shigellosis occur annually in the United States, which can lead to dysentery or even death in severe cases. One of the most common transmissions of shigellosis is through water contaminated with human fecal matter. Likewise, in the U.S. approximately 1-5 percent of the population will develop mild amebiasis each year, again commonly attributed to contaminated wastewater.

Recent tests have also found giardia in a surprising 7 percent of all stool samples tested nationwide, indicating that this disease is on the rise in the U.S. and is a much more widespread problem than was originally believed. Exposure to unfiltered streams or lakes that may be contaminated by human or animal feces is a common source of giardiasis, where approximately three times more children than adults become infected.

Finally, a 1978 study demonstrated that about 75 percent of all sewage sludge samples taken in U.S. urban catchments contained ascaris ova, which since the early 1900s (when U.S. wastewater treatment practices drastically improved) was a condition normally associated much more with the developing world. Yet recent studies estimate the prevalence of ascariasis in the U.S. as affecting perhaps as many as 4 million individuals.

The evidence is clear: wastewater that is not disinfected in the U.S. is a public health liability. The continued occurrence of U.S. waterborne disease outbreaks demonstrates that contamination of water still poses a serious health risk here. This means the U.S. still has much work to do in further reducing these diseases nationwide, and stricter regulatory oversight of our nation's WWTPs is a logical first step. With up to 50 billion gallons of sewage flowing through U.S. sewage treatment plants every day, the protections provided by USEPA regulations regarding disinfection are well warranted.

And while many of the waterborne diseases listed in table 1 are more prevalent in locations around the world with poor sanitation practices, the fact that CAWS effluent is not disinfected, uniquely positions Chicago as a major U.S. city *without* adequate sanitation practices at its WWTPs.

[13] Some types of cryptosporidia cysts have been shown to be very resistant to chlorination disinfection, though filtration may help. The cysts can also remain in the ground and water for months.

Because the numbers of pathogenic organisms present in wastes and polluted waters are difficult to isolate and identify, coliform organisms, which are more permits. Because of the concern that wastewater can spread waterborne diseases, all State environmental protection agencies and public health agencies require disinfection of municipal wastewaters unless there is a compelling and unique reason for not doing so. As such, Illinois has a statewide requirement that effluent from wastewater treatment plants must not exceed a certain level of fecal coliform.[14] Yet the State has not placed a requirement in MWRD's NPDES permits that would require disinfection of wastewater effluents at its three main plants on CAWS. This is likely attributable to two main reasons:

1. The requirement to disinfect MWRD's wastewater was removed in 1984 partly due to the concerns over the negative impacts of chlorine in the environment, which was the disinfection treatment MWRD used at that time *(MWRD was not also using de-chlorination in tandem with chlorination, which might have helped ease some of these impacts, though some chlorine byproducts are not removed with de-chlorination).*

2. IEPA has somewhat limited the scope of its assessment of CAWS. The regulations applicable to most Illinois discharges state that effluents shall not exceed 400 fecal coliform units per 100 mL unless the discharger shows it will not cause a violation of fecal water quality standards. In addition, these regulations state that fecal coliform levels should generally not exceed 200 per 100 mL between the months of May through October, unless the water is not fit for primary contact.[15] IEPA has historically interpreted this last exception very broadly, implying that CAWS has not been "fit for primary contact". But this is partly attributable to the fact that wastewater discharges to CAWS <u>*are not disinfected*</u>. As such, Illinois' policy presents a circular argument. Regardless, as the recent UAA proceedings should confirm, CAWS is being used for such contact uses. Therefore, by law CAWS must be *made fit* for such uses.

All States have similar requirements as the Virginia Department of Health (VDH), which for example states:

> Disinfection of wastewater is a preventive method of minimizing the numbers of actual or potential microorganisms reintroduced to the environment. It is designed as one of the multiple barriers against the transmission of infectious disease. The number of pathogenic organisms that could be present in treated but undisinfected sewage effluent are sufficient to result in a reasonable probability of infection upon contact with waters to which the sewage is discharged. (VDH website, 2007)

Thus, the policy of the VDH is that "adequate protection of public health requires elimination of possible contact (with an infective dose of pathogens) through use of

---

14

disinfection and dilution. Sewage effluents should be disinfected and adequately diluted when discharged" (VDH website, 2007). This is for good reason, as the adverse impact of undisinfected wastewater on an unsuspecting public raises several very serious health and safety concerns: experts estimate that a gram of human waste contains more than one billion viruses and bacteria, that there are more than 1,400 disease and chronic disease-causing microbes in humans (including bacteria, viruses, fungi and parasites), and that roughly 15 million of the estimated 57 million deaths around the world each year can be linked to infectious diseases (USEPA website, 2007).

While there are no formal studies of the adverse public health effects on the members of the public who use CAWS for recreation purposes, there *is* limited anecdotal information about people who have been exposed to the water and have become sick. The MWRD, in collaboration with partner organizations, has recently embarked on conducting a full epidemiological study to ascertain such risks specifically associated with CAWS in its current condition.

While acquiring this data, especially in an updated model, is generally beneficial, such a study must not be used as an excuse to avoid taking appropriate actions based on what has already been well-studied and is well-known: 1) high fecal coliform and *E. coli* bacteria levels are good indicators of the presence of pathogens that are dangerous to human health and aquatic life[16]; 2) extremely high levels of these indicator organisms

C. The Region's Wastewater Discharges – Stewardship in Need of Tending

Approximately 70 percent of CAWS' annual flow is wastewater effluent. Therefore, the water in CAWS contains greatly elevated levels of bacteria and pathogens - levels higher than the USEPA's recommended levels for human contact. Contamination by bacteria and other microorganisms significantly limits a variety of waterway uses, including recreational activities in which humans contact the water directly. Omitting some important operational areas, today MWRD complies almost 100 percent with basic existing pollutant discharge permits.[17] In the case of bacteria, however, permit limits are nonexistent for much of the river, thereby making "compliance" a hollow assurance.

In March 2007, USEPA reported that MWRD is the only agency in all major U.S. cities nationwide that does not disinfect much of its wastewater effluent where whole or partial body contact occurs or can occur. USEPA also cited three other cities (Kansas City, St. Louis and Memphis) which do not currently disinfect all of their effluent. <u>USEPA is pressing for disinfection in these three cities.</u>

Illinois has limited the level of harmful bacteria allowed on small sections of CAWS. The fecal coliform limits for waters designated General Use—400 cfu/100 mL—presently applies to the North Shore Channel above the North Side Water Reclamation Plant, on the Calumet River above the O'Brien Lock and Dam, and on the Chicago River east of Wolf Point. All of these areas would be downgraded with the new IEPA 2007 proposed standards to 1,030 cfu/100 mL, with the exception of the Calumet River location, which would be downgraded to 2,740 cfu/100 mL. While much of the rest of the North and South Segments would be upgraded to 1,030 cfu/100 mL once bacteria limits are imposed with the new proposed standards, these limits would not protect for all uses and attainable uses, as previously mentioned. Furthermore, the majority of the Chicago Sanitary and Ship Canal would be "downgraded" to having no bacteria standards at all under the new proposed designations.[18] These proposed standards spell continued trouble for CAWS water quality. The river is a whole system, and people are using the

CAWS during dry weather, and potential public health risks. The data represent a 17-month continuous sampling spanning a time period from August 2003 through December 2004.[21] The data show that: 1) there is a strong correlation between extremely high fecal and *E. coli*

Figure 4

- Most recently, a MWRD letter presented at a March 22, 2007 Stakeholder Advisory Committee meeting held in Chicago: *"These are not natural rivers, but an artificially created, operated and maintained waterway system to serve the needs of the metropolitan area for urban drainage and commercial navigation".*

This position is at odds with MWRD's heritage of improving water quality for the benefit of the public throughout CAWS. Clearly, if public health is to be protected, disinfection and public access to the Chicago Area Waterway System should be encouraged. After all, the public is increasing its use of CAWS whether it is discouraged from doing so or not.

Moreover, MWRD's position is at odds with both the public and the City's historic "vision" of what the river can be, illustrated by the late Mayor Richard J. Daley, who "once spoke about a day when Chicagoans would flock to the river to fish and relax". That vision has been extended to Mayor Richard M. Daley's 2005, "Chicago River Agenda" report, in which he states:

> *"The Chicago River has a long and storied history that has captured our imaginations since Chicago's early days…Daniel Burnham pictured grand architecture and the development of the river as a recreational corridor…The Chicago River continues to inspire our imaginations today. As it has improved, our vision for it has changed to reflect possibilities that would have seemed like impossible dreams only a few decades ago. The Chicago River today is Chicago's Second Shoreline, a natural and cultural resource that plays many vital roles in the life of our city".*
>
> \- Chicago Mayor Richard M. Daley

The Mayor's Chicago River Agenda outlines numerous and exciting projects underway, many with ambitious goals targeted for as early as 2010 that will improve public access to the river (more than 13 miles of riverfront trails), restore public riverbanks (3 miles), and create multiple river parks (more than 65 acres), just to name a few.[23]

The City of Chicago "encourages MW

The City has also committed itself to aggressive stormwater management and CSO controls, as well as a variety of green infrastructure initiatives, which will all enhance water quality on the River. Moreover, through its River Agenda the City "encourages MWRD to implement cost-effective disinfection

[23] The Chicago River Agenda has targeted 46 new acres by 2010, and the additional acreage was disclosed through a City presentation at the March 22, 2007 Stakeholder Advisory Committee meeting held in Chicago.

reporting by lakefront municipalities, the number of Illinois Lake Michigan beach closings and swimming bans per year has increased from 1994 to 2002 (see figure 5). Overflows that lead to lake reversals negatively impact the ecology of sensitive coastal beach and aquatic habitats, including for a variety of plants and animals that depend upon wetlands, reefs and dune areas. These overflows to our area beaches can of course be hazardous to people as well.

Though there are numerous sources of beach closings, including stormwater runoff and animal waste, overflows from CAWS to Lake Michigan are an identifiable and significant source of closings and bans. While nature cannot easily be controlled, the City of Chicago and other groups are taking steps to identify and reduce non-point source pollutants from this region's shorelines. Anthropogenic sources can more easily be mitigated, representing one of the largest contributors of pathogens in CAWS. Completion of TARP plays a very significant role in the mitigation of human wastes that potentially foul our shorelines, but that is not the only actor.

During a reversal to the lake, it has not been determined what entering concentrations of pathogens are attributable to CSOs versus normal operating discharges from MWRD into CAWS. CSO events that are large enough to cause a reversal likely contain several times over the number of pathogens than are already present in the normal flow of CAWS, which is dominated by about 70 percent of its flow as WWTP effluent. Although pathogenic levels during a reversal would most certainly breach beach safe limits even if ambient water quality in CAWS was pristine up until the point when CSOs occurred, the fact that ambient CAWS water quality contains egregious levels of pathogens to start out with, only elevates these levels at the time of a reversal, and potentially exacerbates public health risks at area beaches. Poor CAWS water quality is largely attributable to two factors: 1) lack of wastewater disinfection; and 2) CSOs.

Additionally, overflows to the river itself that do not end in reversals to Lake Michigan are continuing, increasing the number of potentially hazardous pathogens in CAWS. There were approximately 60 such overflows to CAWS in 2006. The good news is that CAWS reversals appear to be occurring less frequently thanks in large part to MWRD's progress in building TARP. Nevertheless, with the indefinite possibility of CAWS reversals, to protect the lake, we must protect the river. It is more important than ever to take steps to reduce pathogenic pollution to improve CAWS water quality. Those steps include a combination of disinfection of wastewater effluent, full implementation of the Nine Minimum Controls for CSOs and successful completion of TARP.

B. Aquatic Health

The water quality in the Chicago Area Waterway System has improved over the decades, and with increased improvements, we have witnessed a consistent resurgence in aquatic life. In the 1970s it is estimated that there were only about 10 fish species present in CAWS, whereas today, that number has increased to perhaps as many as 70. These species include popular game fish, such as smallmouth bass, which started arriving in 1988, as well as largemouth bass and bluegill, which are regularly seen in CAWS today. After the passage of the CWA in 1972, several point source pollution problems were identified and eliminated, and as a result fish species numbers tripled before the decade was over.

It is now time for CAWS to fulfill the CWA legacy and once again, eliminate the sources of contamination in the form of MWRD's CSOs and other polluted wastewater. Science indicates ecosystem functioning increases with species diversity. A cleaner, more natural Chicago River system may in turn prompt stakeholders to improve CAWS spawning areas for instance, which could lead to increased fish populations as well as early life stages for a variety of aquatic species. The natural ecosystem chain will start to regenerate. Chicago has recently identified areas in its 2005 Chicago River Agenda where it will begin to help foster precisely this kind of aquatic life change by improving and restoring integral habitat. The change does not stop underwater. Diverse bird populations that may be able to utilize CAWS for their feeding and nesting resources could increase as well. This could be expected to spread through the river ecosystem chain to creatures like beaver, foxes, muskrats, turtles, and many more species that are beginning to return, sometimes in otherwise surprisingly urban landscapes. Even the state-endangered black crowned night heron is beginning to be sighted by paddlers. Benefits to wildlife, people and the economy could be truly extraordinary.[24]

The Case for Change – Economics

A. Protecting Nature Pays

Swimming bans are not just a disappointment to people who want to have their day at the beach. Swimming bans and beach advisories can also translate into significant losses to their pocketbooks, as well as local economies. According to one recent Ohio State University study done on Lake Erie, eliminating the need for beach advisories due to bacterial contamination would have a lakewide value for beachgoers of up to $10.35 million per year for 15 beaches, or an economic benefit of $690,000 per beach, per year.[25] Chicago alone has 23 major public beaches, indicating a net economic benefit from eliminating releases (and/or vastly improving river water quality when releases occur) at approximately $15.87 million per year, if the locks do not open and swimming

of birders watching from the comfort of their homes. Forty percent of birders travel more than a mile to bird, and they spend money on binoculars, field guides, bird food, bird houses, camping gear, and big ticket items such as boats, as well as travel-related costs.

gastroenteritis at $36.58 = $14,632,000 for one incident, and this is for the human health cost alone).[30]

Though the public policy debate over disinfection almost always immediately jumps to "cost," it is important to remember that upgrades to water quality standards are required under the Clean Water Act *without respect to cost.* The only exception to this is where controls that are more stringent than those to achieve secondary treatment would cause "substantial and widespread economic and social impact". This is assessed through a "feasibility test," rather than a cost-benefit test, and in the case of CAWS and MWRD, this clearly would not

Table 3: Disinfection Methodology Cost Comparisons

Disinfection Total Capital Cost Estimates for the Stickney Plant

UV
MWRD Report = $358 million *(represents a $52 million increase)*
USEPA SAIC Report = $306 million

Ozone
MWRD Report = $497 million *(represents a $52 million increase)*
USEPA SAIC Report = $445 million

Chlor./De-chlor.
MWRD Report = N.A. *(excluded from study)*
USEPA SAIC Report = $138 million *(represents $168 million less than other lowest alternative)*

Disinfection Total Capital Cost Estimates for the Calumet Plant

UV
MWRD Report = $100 million *(represents a $55 million increase)*
USEPA SAIC Report = $45 million

Ozone
MWRD Report = $180 million *(represents a $56 million increase)*
USEPA SAIC Report = $124 million

Chlor./De-chlor.
MWRD Report = N.A. *(excluded from study)*
USEPA SAIC Report = $6 million *(represents $39 million less than other lowest alternative)*

Disinfection Total Capital Cost Estimates for the North Side Plant

UV
MWRD Report = $83 million *(represents a $54 million increase)*
USEPA SAIC Report = $29 million

Ozone
MWRD Report = $162 million *(represents a $54 million increase)*
USEPA SAIC Report = $108 million

Chlor./De-chlor.
MWRD Report = N.A. *(excluded from study)*
USEPA SAIC Report = $49 million *(represents $20 million more than lowest other alternative)*

TABLE 4: Total Annual Operations & Maintenance Cost Estimates (in Millions)

	Stickney			Calumet			North Side		
	UV	Ozone	Chlor/ DeChlor	UV	Ozone	Chlor/ DeChlor	UV	Ozone	Chlor/ DeChlor
MWRD	$12.6	$19.0	N.A.	$4.8	$8.1	N.A.	$4.3	$7.5	N.A.
SAIC	$9.0	$19.0	$11.5	$2.0	$5.0	$3.7	$2.0	$5.0	$4.0
Difference	**$3.6**	**$0.0**	**N.A.**	**$2.8**	**$3.1**	**N.A.**	**$2.3**	**$2.5**	**N.A.**

TABLE 5: Annual Debt Services Cost Estimates (in Millions)
(based on an interest rate of 5.5% for 20 years)

	Stickney			Calumet			North Side		
	UV	Ozone	Chlor/ DeChlor	UV	Ozone	Chlor/ DeChlor	UV	Ozone	Chlor/ DeChlor
MWRD	$30.0	$42.0	N.A.	$9.0	$15.0	N.A.	$7.0	$14.0	N.A.
SAIC	$26.0	$37.0	$11.5	$4.0	$10.0	$0.5	$2.0	$9.0	$4.1
Difference	**$4.0**	**$5.0**	**N.A.**	**$5.0**	**$5.0**	**N.A.**	**$5.0**	**$5.0**	**N.A.**

Other Municipalities Can Afford it; We Can Too

Many major metropolitan wastewater treatment plants were built during the first few decades of the 20th century. As populations in many of these areas expanded (and continue to expand today), the treatment plants' capacities were and are continuously being challenged. As a result of this population growth, along with stricter environmental laws though the 1970s and beyond, and more recently because of security concerns after September 11, 2001, these treatment facilities must continually update their facilities and upgrade their treatment processes.

These critical updates can have large capital costs, especially in the larger metropolitan areas. Standard public financing methods for these projects include:

- Increasing household sewage rates
- Using State Revolving Fund loans
- Levying special taxes
- Debt financing/bonding
- Using other federal grants
- Using a combination of the above

There are countless examples of municipal wastewater treatment facilities that effectively build new disinfection capabilities into their operations. They pay for this by one or more of the above mentioned financing options. It is a common and necessary occurrence to update and upgrade wastewater treatment facilities, including capital costs, ongoing annual operations and maintenance costs, and annual debt service costs, as they may relate to advanced disinfection treatments. Some examples:

- The **Milwaukee Metropolitan Sewerage District (MMSD)** has two main treatment plants that serve the city. The Jones Island Treatment Plant has a design capacity of about 300 million gallons per day (MGD), and the South Shore Treatment Plant has

disinfection technologies simply through consumer rates.[34] A total of $2.6 billion was earmarked in Detroit for about a 5-year wastewater treatment capital improvement program (to extend approximately into 2010). $434 million of this budget was allocated to cover water and sewer projects for 2005-06 alone. This is the latest in a consistent series of budget allocations to the sewage agency stemming from its inception in 1940, and with direct improvements to its chlorination/de-chlorination disinfection technology dating as far back as 1957 and 1970.

- In **Rockford, IL**, wastewater treatment (including disinfection) is funded by a variety of sources, 'such as user charges, county and state property taxes, connection charges, interest income, and other miscellaneous sources, such as permits, inspections, and rental income'. More specifically, "user charges fund basic operations and maintenance, capital equipment and infrastructure and replacement or updates to the treatment plant. Taxes, connection charges and cost sharing with developers and other governmental agencies provide sources for infrastructure additions and improvements" (Rock River Water Reclamation District Website). Recently on January 22, 2007, Rock River's Board of Trustees approved ordinances that will implement about a 9 percent sewage treatment rate hike, reflective on bills as of April 6, 2007. This means that the average household in the service area can expect a rate increase of about .73¢ per month, or $8.76 per year.[35]

- The **Sanitary District of Decatur (SDD), IL** was formed on Oct. 11, 1917, and became the first such district to organize under the state's Sanitary District and Sewage Disposal Act of 1917. SDD's dry weather design capacity has been increased from 27 MGD to 41 MGD, while wet weather flow capacity for full secondary treatment has been increased from 50 MGD to 125 MGD. During the 1980s the SDD **implemented chlorination disinfection technology funded by a federal grant** (procured from federal taxes). The **SDD then later switched to UV disinfection at a cost of about $150 million to implement, and financed through a state revolving fund**, which was then recaptured through user rates. More recently, SDD altered its technology once again, and now bleaches its wastewater effluent.

- In **Schererville, Indiana** (located in Northwest Indiana and served by a relatively small treatment facility with an initial design capacity of 0.5 MGD in 1964, to the

[34] The Detroit Water & Sewerage Department (DWSD) serves virtually all of Wayne, Oakland and Macomb counties, with a daily flow rate of approximately 677 million gallons (which is almost exactly the same daily flow rate of MWRD's Stickney's plant, at 680 MGD).

[35] In 2006 the Rockford City Council approved a 39 percent rate increase for water services (27 percent of that coming in the first year of the three year rate-plan increase which addresses mostly drinking water improvements). This will pay for a $75 million water improvement plan. *The city plans on borrowing the money to pay for the upgrades and pay back the debt over 20 years through the water-rate hike.*

present capacity of 8.75 MGD), **recent upgrades in 2003 included implementing UV disinfection technology**. The 8 major capital improvements needed for their facility since its inception, and precipitated by population growth in the region (presently at 35,000), **were/are funded by user fees, a state revolving fund, and/or a revenue bond, or some combination thereof**.

The message is clear: municipalities are disinfecting their wastewater discharges all the time and funding such efforts in ways that do not break the bank or their ratepayers. If they can do it, the Chicago metro region can, too.

Solutions: Prescriptions for Change

Step One: Designate all Stretches of CAWS for "Fishable/Swimmable" Uses

Commendably, in January 2007, IEPA proposed designating the North Segment and South Segment of the CAWS for upgraded water quality protections. However, it did not propose appropriate upgrades that would be protective of all current and attainable uses. Nor did it propose any upgrades for the Middle Segment. IEPA needs to upgrade protections for all three segments for full "fishable/swimmable" uses, achievable by 2010.

With the IEPA's proposed standards, most of the North Branch of the Chicago River, most of the North Shore Channel, Grand Calumet River, Cal-Sag Channel, and portions of the Lower Des Plaines River, will all likely see some water quality improvements. They will not however, be fully protective and adequate to comply with federal CWA requirements. In the case of the Chicago Sanitary and Ship Canal, it will continue with the status quo. Just North of the Lockport Lock & Dam on the Lower Des Plaines will also continue with the status quo. The standards applicable to the Calumet River (North of O'Brien Lock & Dam) will be downgraded, as will the standards applicable to the North Shore Channel above the North Side Water Reclamation Plant, and likewise for the Chicago River east of Wolf Point. These last three downgraded areas are especially sensitive due to their close proximity to Lake Michigan.

Step Two: Illinois Environmental Protection Agency Must Include a Disinfection Requirement in MWRD's Pollution Discharge Permits

Once water quality standards have been upgraded in CAWS, IEPA must require MWRD to begin disinfecting its wastewater discharges by March 1, 2010. The proper way for this to take place is to include a disinfection requirement in the National Pollutant Discharge Elimination System (NPDES) wastewater discharge permits for the MWRD's North Side (North Segment), Calumet (South Segment), and Stickney (Middle Segment) plants.

Appendices:

Appendix A – Frequently Asked Questions:
15 fundamental questions addressed by this report.

1. Why do we need to disinfect? What are the risks/benefits?
   - ***Disinfection of wastewater effluent is imperative to significantly reduce exposures to waterborne diseases that make millions of Americans ill each year, sometimes fatally. Many of these diseases affect the most susceptible individuals in our population, such as children, the elderly and our sick; but anyone who comes into contact with contaminated wastewater is at risk.***

2. What sort of illnesses are associated with wastewater/impacts on public health?
   - ***Illnesses caused by contact with or consumption of untreated or inadequately treated wastewater can range from cholera, hepatitis, gastroenteritis, and respiratory infections, to giardiasis, cryptosporidiosis and dysentery, for example. While traceable outbreaks may occur as the result of a specific exposure (e.g. recreating in contaminated water), it is also estimated that some of the referenced waterborne diseases affect as much as 1-7 percent of the U.S. population annually.***

3. What sorts of uses are there in the Chicago area?
   - ***A 2003 joint Alliance for the Great Lakes - IEPA study found unprecedented public use of CAWS, even in places that were supposed to be off limits to public access. During 7.5 days of observations, a total of 1,284 uses were confirmed, including but not limited to activities such as canoeing, kayaking, sculling, power boating, fishing, jet skiing, wading and swimming – this last activity was seen directly in front of the main outfall of the Calumet Wastewater Treatment Plant. Countless others use the CAWS each year for rowing events, paddling day trips, and more. More recently new user groups, access points and boat launches have been cropping up in all sections of the CAWS like never before.***

4. What are US EPA's current water quality standards for pathogens for primary and secondary uses?
   - ***USEPA has set a goal of "fishable/swimmable" waters for our nation. With that end objective in mind, USEPA previously set a limit of 126 E. Coli per 100 mL for full or "primary" Q q 0.24 yters fWhile suexisng in attn oae***

must set bacteria limits that are stringent enough to support primary contact. Based on USEPA standards, many States have adopted fecal coliform limits around 200 cfu per 100 mL for primary waters (though some have significantly more stringent limits). Though they vary greatly, fecal coliform limits for secondary contact waters range from less than 100 cfu/100 mL for a few States, to 1,000 or more cfu/100 mL for many others. Part of the variance in limits from State to State is likely due to expected updates in Federally mandated standards. However, and what should be of special significance to Illinois, is that States are generally prohibited from removing designated uses unless the change will result in more stringent criteria.

5. What are the current water quality standards for IL in the Chicago Area Waterways System?
   - ***The fecal coliform bacteria limits for waters designated General Use consist of a 400 cfu/100 mL standard, which currently applies to three small sections: the North Shore Channel above the North Side Water Reclamation Plant, on the Calumet River above the O'Brien Lock and Dam, and on the Chicago River east of Wolf Point. The rest and majority of the Chicago Area Waterway System is designated Secondary Contact Use with <u>NO BACTERIA LIMITS.</u>***

6. How did we get to where we are in the CAWS with NO pathogen standards for secondary contact recreation?
   - ***This is related to the wastewater treatment practices of CAWS during the 80's. The requirement to disinfect MWRD's wastewater was removed in 1984 partly due to concerns over negative impacts of chlorine in the environment, which was the disinfection treatment MWRD used at that time. Coincidentally, the USEPA mandated "Triennial Review" of waterways of the State was not carried out by IEPA until now, decades later. If this requirement had been implemented every three years from the beginning, it may have helped to confirm secondary and/or primary type uses of the waterways earlier, requiring pathogen standards.***

7. If we do disinfect at the 3 biggest MWRD plants, what is the cost?
   - ***Recent studies find that it would roughly cost $640 million to implement UV disinfection at all three plants, including capital infrastructure & O&M costs for 20 years (an additional $32 million per year for debt service costs). This equates to approximately <u>$8.52 per person per year</u> (based on wastewater discharges to CAWS of 5.4 million users), or $23.28 per household per year (based on 2.73 people per household).***

8. Who pays this cost? Is it worth it for the amount of people it will protect?
   - ***Standard public financing methods for these projects include a variety of proven options: increasing household sewage rates, using State revolving loan funds, levying special taxes, debt financing/bonding, using federal grants, or some combination of any of the above. It is questionable whether it is reasonable or accurate to measure the worth of healthy people, or the value of even one human life, per se. Although lawsuits do monetize these values everyday. Moreover, beyond greatly reducing pathogenic exposure to perhaps 10,000 to 20,000 direct users each year, it has been estimated that disinfecting our wastewater effluent will also bring economic activity into the hundreds of millions of dollars for the Chicago region through increased tourism, recreation, and increased property values for instance, besides bringing our City's wastewater treatment practices back into the developed world.***

9. Why was chlorination/de-chlorination omitted as a potential disinfection technology by MWRD to at least do a cost estimates study on, when it is the most commonly used technique across the U.S. and is usually relatively simple and cheap to implement?
   - ***MWRD indicated that it decided to omit chlorine technologies from their cost study because of safety and environmental concerns if implemented. There is some justification to that, and UV disinfection technology may be the best overall choice in terms of effectiveness, safety and relative environmental impacts. However, because chlorination is currently the most widely used method in the U.S. and is relatively cheap and simple to implement, it seems remiss to exclude it from a comprehensive study. Furthermore, chlorine technologies would possibly be a better alternative to the current disinfection method on CAWS, which is nothing. As such, and much to its credit, USEPA commissioned Science Applications International Corporation (SAICUuar e5 1541 Tmc1 such,2.0801 0 0 -50 375 2059 Tm /I***

chlorination disinfection in the U.S., when high dissolved organic carbon concentrations are present in the wastewater, high concentrations of byproducts can result. Wastewater is then discharged into surface waters, where the byproducts may be diluted, degraded, volatized (go into the air), or get absorbed into nearby sediments. For chlorination, preventative measures that reduce risks include de-chlorination after chlorination, though this is not a totally effective safeguard. Ironically, UV is now emerging as the most effective de-chlorination method. In many cases UV is capable of removing both free chlorine and chloramines and provides a better overall water quality (somewhat dependant on conditions of the influent). Additionally, UV used as a de-chlorination method can save on maintenance costs sometimes associated with fouled equipment associated with other de-chlorination methods, such as granular activated carbon or sodium bisulphate. Finally, it is thought that because of the effectiveness of MWRD's treatment processes (in this regard), that their effluent has reduced ammonia content, which should help to minimize the formation of some chlorination byproducts.

11. How can river contamination affect Lake Michigan and the beaches potentially?
    - ***During times of especially heavy rains, MWRD is sometimes forced to open gates in three locations on CAWS that otherwise keep the waterway system***

12. What is TARP and won't this address CSOs and reversals?
    MWRD's Tunnel And Reservoir Plan (also known as "Deep Tunnel"), began in the 1970s. TARP is the largest public works project ever implemented in the Chicago area, with an estimated final cost of $3.4 billion. It consists of reservoirs and tunnels about 240-350 feet below ground, stretching 109 miles throughout Cook County. TARP conveys wastewater to the storage reservoirs until it can be treated at the WWTPs and discharged during dry weather. Once fully completed, TARP will enable MWRD to store and then treat up to approximately 17.2 billion gallons of wastewater before discharging it into CAWS, greatly reducing CSOs and the potential for a river to lake reversal. There will, however, likely continue to be some CSOs after particularly heavy rains after the completion of TARP. Moreover, TARP is not designed to address the problem of pathogens that are constantly discharged from the Calumet, Northside and Stickney plants and will not reduce the levels of pathogens discharged from those plants.

13. Where does the river water go to since the flow has been augmented & how is the downriver water quality?

15. What would happen if after a CSO forced a gate opening river water reached the water intake system: could it happen and would we be protected and what would happen to our drinking water supply?
    - ***These are valid concerns. When Chicago River system reversals occur, municipal drinking water agencies are forced to increase the level of chlorine they must apply to drinking water supplies so as to safeguard the public from the risk of contamination. While chlorine is meant to safeguard public health and most of the added chlorine dissipates before reaching domestic taps, chlorine itself is not without its own health risks. Studies indicate that cancer-causing agents, trihalomethanes and haloacetic acids, are the two largest classes of byproducts in treated drinking waters, though a recent EPA national occurrence survey of selected public water-treatment plants reported the presence of 50 high-priority byproducts and detected more than 200 previously unidentified byproducts. Additionally, human epidemiology and animal toxicology studies report an association between chlorinated drinking water and reproductive and developmental endpoints such as spontaneous abortion, still birth, neural tube defect, pre-term delivery, intrauterine growth retardation, and low birth weight. Approximately 240 million Americans (80 percent) drink tap water contaminated with some level of disinfection byproducts today (EWG, 2001).***

Appendix B –
i. Clean Water Act Requirements Relating to Water Quality Standards

The requirements of the Clean Water Act (CWA) are very clear:

Section 101 (a) says: "The objective of this chapter is to restore and maintain the chemical, physical and biological integrity of the Nation's waters".

Section 101 (a) (2) says: "It is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in an on the water be achieved by July 1, 1983:" (This is commonly referred to as the "fishable/swimmable" requirement of the Act)

Section 101 (a) (7) made it national policy that programs (to meet the objectives of the Act) would be "developed and implemented in an expeditious manner".

Water quality standards are aimed at translating these broad goals of the CWA into waterbody-specific objectives. A water quality standard consists of two major elements: (1) the <u>designated beneficial use or uses</u> of a waterbody or segment of a waterbody; and (2) the <u>water quality criteria</u> necessary to protect the use or uses of that particular

scientific rationale and must contain sufficient parameters or constituents to protect the designated use. For waters with multiple use designations, the criteria shall support the most sensitive".

USEPA has developed and issued a document titled "Water Quality Standards Handbook". The following information was extracted from that Handbook (Second Edition):

> -"A State must designate either primary contact recreational uses or secondary contact recreational uses for all waters of the State and, where secondary contact recreation is designated, set bacteriological criteria sufficient to support primary contact recreation. EPA believes that a secondary contact recreational use (with criteria sufficient to support primary contact recreation) is consistent with the CWA section 101(a)(2) goal. The rationale for this option is discussed in the preamble to the Water Quality Standards Regulation, which states: " . . . even though it may not make sense to encourage use of a stream for swimming because of the flow, depth or the velocity of the water, the States and EPA must recognize that swimming and/or wading may occur anyway. In order to protect public health, States must set criteria to reflect recreational uses if it appears that recreation will in fact occur in the stream".

> -"The most significant misperception about designated uses and UAAs is that UAAs need only address the current condition of a waterbody: that a designated use may be removed simply by documenting that protective criteria are exceeded. However, it is the prospective analysis of future attainability of designated uses that provides the demonstration necessary to support a use change. A related misconception is that UAAs are only a means to remove a designated use. In fact, UAAs have supported both removing uses and adding uses. The program experience and future direction reflects a growing practice of "sub-categorizing" or "refining" designated uses; that is, making them more specific and precise as opposed to removing them".

> -"Many of our waters do not meet the water quality goals envisioned by the Clean Water Act. Many of the problems have been produced over many years and may take many years to resolve. Some problems may take substantial changes in resource management to implement solutions. A process of setting incremental water goals through refined designated uses, that in turn advances progress toward an ultimate goal, can help us achieve our long term goals faster".

It is the primary right and responsibility of the State of Illinois to establish water quality standards for all waterbodies in the State. The Illinois EPA develops and proposes water quality standards, including designated uses to the Illinois Pollution Control Board. Once the Board formally adopts the water quality standards, they become fully effective and guide water pollution decisions made by the IEPA.

USEPA reviews new or revised water quality standards that States adopt to determine whether the standards meet Clean Water Act requirements. USEPA disapproves a State's water quality standards, or determines that a new or revised water quality standard is necessary to meet the requirements of the Clean Water Act. Opportunities for public comment on proposed water quality standards are provided at a minimum of two steps in the overall approval process.

Once water quality standards are established, the Clean Water Act requires a State to review those standards at least once every three years (the "triennial review"). Designated uses may be revised during this periodic review. It is very important to note that IEPA has not conducted a triennial review of the water quality standards on the CAWS for over 20 years.

ii. Designated Uses and Existing Uses

The water quality standards program categorizes water uses in two ways: designated uses and existing uses. A designated use is the legally applicable use specified in the adopted water quality standards for a waterbody or segment of a waterbody. A designated use is a use that, presently, may or may not be met or "attained". In effect, the designated use is the goal set for the waterbody. All pollution control activities associated with a waterbody (such as the conditions established in NPDES permits) are designed to attain the designated uses. It is very important to note that designated uses for a waterbody can be changed. Changing a designated use also results in a change in the applicable water quality criteria associated with that new designated use.

Designated uses include recreation; protection and propagation of fish and other aquatic life and wildlife; agriculture; industrial processes; and navigation. USEPA does not recognize waste transport as an acceptable use.

The term "existing use" has a somewhat different meaning in the context of the CWA. Rather than actual or current uses, it refers not only to those uses the waterbody is capable of supporting at present but also any use to which the waterbody has actually attained since November 28, 1975. Even if the waterbody is currently not supporting a use attained since November 28, 1975, for purposes of the CWA, it is still an "existing use" (even if there has been no documentation that a use has occurred since November 28, 1975, evidence that water quality has been sufficient to support a given use at some time since November 28, 1975, can be the basis for defining an "existing use" for a waterbody).

Commonly used use designations include the following:

Drinking water
Water-based recreation
- **Primary Contact: partial body/whole body contact**
- **Secondary Contact: limited contact**
Fishing
Aquatic life
- **Warm water species and habitat**
- **Cold water species and habitat**
Agriculture water supply
Industrial water supply

The terms listed in bold text are examples of subcategories of uses. The subcategories under water-based recreation refer to the proportion of time in which someone engaging in certain types of activities would come into direct contact with the water. Recreational uses have traditionally been divided into primary contact and secondary contact recreation. The primary contact recreation classification protects people from illness due to activities involving the potential for ingestion of, or immersion in, water. Primary contact recreation usually includes swimming, water-skiing, skin-diving, surfing, and other activities likely to result in immersion. The secondary contact recreation classification is protective when immersion is unlikely. Examples are boating, wading, and rowing. These two broad uses can be logically subdivided into an almost infinite number of subcategories (e.g., wading, fishing, sailing, power boating, rafting). Obviously, it can be difficult to draw distinct lines between these different activities, because the extent of exposure can be affected by factors such as the skill of the recreationist and weather conditions. Nevertheless, such distinctions can be very important, as concentrations of pathogens and other key pollutants need to be lower in waters used for primary or long-term contact activities than for short-term activities, if the health of users is to be protected adequately. Warm water fisheries are those characterized by species of fish and other animals that can tolerate higher temperatures in the surrounding water than can species such as trout and salmon, whose body chemistry requires them to be in colder waters. Bass and perch are examples of warmose body

50 mg/L or less and a second designated use requires 25 mg/L or less, then meeting the second designated use (and the corresponding water quality criteria of 25 mg/L) automatically results in meeting the first designated use and its corresponding water quality criteria.

iii. Water Quality Criteria

Water quality criteria describe the quality of water that will support each designated beneficial use. Water quality criteria are levels of individual pollutants or water quality characteristics, or descriptions of conditions of a waterbody that, if met, will generally protect the designated use of the water. For a given designated use, there are likely to be a number of criteria dealing with different types of conditions, as well as levels of specific chemicals. Since most waterbodies have multiple designated uses, the number of water quality criteria applicable to a given waterbody can be very substantial.

Water quality criteria may be expressed as either numeric limits or as a narrative standard. Examples of water quality criteria are a dissolved oxygen level of 5 milligrams per liter to support a warm water fishery. Water quality criteria must be scientifically consistent with attainment of designated uses. This means that only scientific considerations can be taken into account when determining what water quality conditions are consistent with meeting a given designated use. ***Economic and social impacts are not considered when developing water quality criteria.***

Water quality criteria can be divided up for descriptive purposes in many ways. For instance, numeric criteria (e.g. "weekly average of 5 mg/L dissolved oxygen") can be contrasted with narrative criteria (e.g. "no putrescent bottom deposits"). Criteria can also be categorized according to what portion of the aquatic system they can be applied to: the water itself (water column), the bottom sediments, or the bodies of aquatic organisms (fish tissue). The duration of time and effect to which they apply is another way of dividing water quality criteria, with those dealing with short-term exposures that have the 'capacity to cause mortality or other adverse effects' (acute), being distinguished from those addressing long-term exposure that have the capacity to 'cause injurious or debilitating effects' (chronic).

EPA publishes recommended water quality criteria corresponding to a number of key designated uses. For aquatic life uses, criteria for both acute and chronic exposures are provided. Many human health criteria, *except certain pathogens*, address chronic exposures.

iv. Use Attainability Analysis Process (UAA)

When establishing a designated use for a waterbody that does not meet the "fishable/swimmable" goal of the Clean Water Act, USEPA water quality standards regulations require that a State conduct a UAA to determine the achievable uses of a waterbody. A UAA is a structured scientific assessment of the physical, chemical,

uses are protected for all General Use waters whose physical configuration permits such use). Secondary Contact and Indigenous Aquatic Life use standards were agencies are forced to increase the level of chlorine they must apply to drinking water supplies so as to safeguard the public from the risk of contamination. While chlorine is meant to safeguard public health and most of the added chlorine dissipates before reaching domestic taps, chlorine itself is not without its own health risks.

In 1974, scientists identified the presence of chlorination byproducts, specifically trihalomethanes (THMs), in public water supplies- a discovery that would lead to one of the greatest risk-benefit balancing acts in US environmental regulations[37]. Within a few years of the discovery of THMs in drinking water, the substantiation of their harmful effects was significant. Epidemiology and toxicology studies have shown a link between bladder, rectal and colon cancers and disinfection byproduct exposure. Additionally, human epidemiology and animal toxicology studies report an association between chlorinated drinking water and reproductive and developmental endpoints such as spontaneous abortion, still birth, neural tube defect, pre-term delivery, intrauterine growth retardation, and low birth weight. Approximately 240 million Americans drink tap water contaminated with some level of disinfection byproducts today (EWG, 2001).

In recent years, there has been significant discussion about chlorination practices during drinking water treatment and the associated formation of THMs and other halogenated organic compounds which may be harmful to human health. Concentrations of byproducts in drinking water are subject to government regulations and concern has led to the development of standards for the THMs and HAAs, while standards for other common byproducts are expected in the near future[38].

Wastewater: Good public policy suggests preventative action: disinfecting wastewater discharges at the source to reduce the risk of pathogenic pollution and chlorine over-exposure later. Other preventative measures include "de-chlorination" after chlorinating, and with current progressive technologies widely available, another more obvious choice would be to utilize alternative disinfection techniques, such as UV.

Nonetheless, chlorination is still the most widely used technology for disinfecting wastewater. And the potential for formation and type of byproducts from chlorine can vary based on local water source composition. When high dissolved organic carbon concentrations are present in the wastewater, high concentrations of byproducts can result[39]. Wastewater is then discharged into surface waters, where the byproducts may be diluted, volatized (go into the air), or get absorbed into nearby sediments[40].

Gradually researchers have come to recognize that all forms of disinfection commonly in use, including chloramines, chlorine-dioxide and ozone, will alter the composition of trace chemicals that are found in potable water and subsequently consumed at the

---

[37] Rook, 1974, Bellar et al, 1974.
[38] Pontius, 1996, 1999.
[39] Jekel and Roberts, 1980, Fujita et al, 1996
[40] Rostad 2002.

tap[41]. Studies indicate that THMs and haloacetic acids (HAAs) are the two largest classes of byproducts in treated drinking waters, though a recent EPA national occurrence survey of selected public water-treatment plants reported the presence of 50 high-priority byproducts and detected more than 200 previously unidentified byproducts[42].

The USEPA initiated a strategy to strengthen barriers to pathogens and limit exposure to disinfection byproducts in 1998 with the Stage 1 Disinfectants and Disinfection Byproducts Rule. The purpose was to improve public health protection by reducing exposure to disinfection byproducts. This rule, the first of a set that would reduce the allowable levels of byproducts in drinking water, established seven new standards and a treatment technique of enhanced coagulation or enhanced softening to further reduce byproduct exposure. The rule was designed to limit capital investments and avoid major shifts in disinfection technologies until additional information was available on the occurrence and health effects of byproducts. Also, this rule eliminated the long standing exemption from health standards for systems serving less than 10,000 people. The Stage 2 Disinfection Byproducts Rule, published January 2006, supplements existing rules by requiring water systems to meet byproduct standards at each monitoring site in the distribution system. It also contains a risk-targeting approach to better identify monitoring sites where customers are exposed to high levels of byproducts. This regulation applies to all systems that add a disinfectant other than UV[43].

[41] Johnson et al, 1981.
[42] Pourmoghaddas et al, 1993, Krasnser, 1989; USEPA, 2002.
[43] USEPA, 2006.

Glossary

BMPs **Best Management Practices** - *Methods that have been determined by the U.S. Environmental Protection Agency to be the most effective and practical means of preventing or reducing pollution with a goal of increasing efficiency. The USEPA works with partners in industry and the academic community to establish and publish BMPs for different industries.*

BOD **Biochemical or Biological Oxygen Demand** - *The amount of oxygen required by aerobic biological processes to break down organic matter in water. BOD is a measure of the "level of pollution" of biodegradeable waste on dissolved oxygen in water.*

CAWS **Chicago Area Waterways System** – *A waterway system consisting of 78 miles of rivers, streams and Lake Calumet, located within Cook and surrounding counties. It's main arteries include the North Shore Channel, North Branch of the Chicago River, Chicago River, South Branch of the Chicago River, South Fork of the South Branch, Calumet River, Grand Calumet River, Little Calumet River, Lake Calumet, Cal-Sag Channel & the Chicago Sanitary & Ship Canal (CSSC).*

CFU **Colony Forming Unit** - *A bacterial colony presumed to have originated from a single bacterium present in the sample. Commonly used as a measurement for indicator organisms such as E. coli and fecal coliform.*

CSO **Combined Sewer Overflow** – *CSOs occur in sewage systems that have combined sewage and storm pipes. When heavy rains overwhelm the sewage system's capacity to transport, store and/or treat the wastewater and stormwater, a pipe discharges the "overflow" into the receiving water body so that toilets, sinks, etc. do not backflow with raw sewage. CSOs may consist of raw sanitary waste and storm water, as well as untreated industrial wastes, floating debris, and other contaminants. CSOs usually contain high concentrations of disease-causing pathogens, and 1.2 trillion gallons of CSOs are dumped into the environment each year, posing major health concerns.*

CSSC **Chicago Sanitary & Ship Canal** – *The CSSC, as part of the Chicago Area Waterways System, was artificially modified and created to transport wastes away from Lake Michigan, and was completed in 1900.*

humans). It is used as an indicator of the potential presence of pathogens. Measured in number of bacteria per 100 milliliters of water.

engineering studies or major construction, and can be implemented in a relatively short period of time.

NPDES **National Pollutant Discharge Elimination System** – *The passage of the CWA in 1972 also established the NPDES. Under USEPA oversight, the system was designed to "eliminate polluting materials from municipal and industrial discharges to the nation's waterways." Its mechanism is by regulating point source pollution and placing limits in discharge permits.*

O&M **Operations & Maintenance** – *Standard practices and upkeep of a wastewater treatment facility (for instance), often used in relating the cost associated with those mechanisms.*

PATHOGENS *Microorganisms that can cause disease in other organisms (i.e. humans, animals and plants). They may be bacteria, viruses, parasites or fungi, and are found in sewage or in runoff from livestock for example.*

SAC **Stakeholder Advisory Committee** - *As part of the Use Attainability Analysis study, IEPA forms and holds SAC meetings to bring together all parties who use or have an opinion on the proposed uses of the waterways. This is done in order to make the process as inclusive and informative as possible.*

SAIC **Science Applications International Corporation** – *An independent research and engineering firm that has consulted and worked with a variety of clients (including the U.S. government) on a variety of issues. SAIC performed an independent analysis of CTE's disinfection cost estimates for MWRD's three largest plants.*

SDC **Sanitary District of Chicago** - *In 1889, the Sanitary District of Chicago, which later became the MWRD, was created to protect drinking water supplies and improve the Chicago River's deplorable condition. The SDC reversed the flow of the river during the first decade of 1900 so that sewage would move away from Lake Michigan, thereby protecting the region's drinking water supply.*

SDD **Sanitary District of Decatur** - *The Sanitary District of Decatur was formed in 1917, and serves the wastewater and industrial treatment needs of the City of Decatur, as well as other villages.*

TARP **Tunnel & Reservoir Plan ("Deep Tunnel")** -

Cook County. TARP conveys wastewater to storage reservoirs until it can be treated at MWRD's WWTPs and discharged during dry weather. Once fully completed, TARP will enable MWRD to store and then treat up to approximately 17.2 billion gallons of wastewater before discharging it into CAWS, greatly reducing CSOs and the potential for a river to lake reversal.

THMs **Trihalomethanes** - *Are a group of carcinogenic chemicals that may form as byproducts of disinfection (e.g. chlorination) when they react with organic and inorganic matter in treated water. HAA and THM limits are regulated by USEPA.*

UAA **Use Attainability Analysis** – *Mandated from USEPA, a UAA "is a structured scientific assessment of the factors affecting the attainment of uses specified in Section 101(a)(2) of the Clean Water Act (the so called 'fishable/swimmable' uses)." This analysis "must be conducted for any water body with designated uses that do not include the 'fishable/swimmable' goal uses," and the water bodies must be reexamined every three years to determine if standards need to be revised, to either downgrade or upgrade the designated uses. "If new information indicates that 'fishable/swimmable' uses can be attained, such uses must be designated." The factors that may be used in the analyses include physical, chemical, biological and economic use criteria.*

USEPA **United States Environmental Protection Agency** - *The USEPA was created in 1970 as an independent regulatory agency responsible for the "implementation of federal laws designed to protect the environment." USEPA programs include: establishing protective environmental standards and enforcing those standards, carrying out research on pollution proliferation, effects and mitigation, and assisting others in eliminating pollution from our environment though technical capabilities, grants, and so forth.*

UV **Ultraviolet (disinfection)** – *UV is the most popular and rapidly growing alternative to chlorination/de-chlorination with perhaps as many as 2,000 plants (10 percent) in North America using this method. UV can be very effective at destroying pathogens and inactivating viruses by damaging their genetic structure. It also is generally more effective than chlorination at inactivating viruses, spores and cysts. However, the overall effectiveness of UV also depends on the turbidity and other related factors of the wastewater effluent. There are no known significant toxic byproducts with UV disinfection. UV is generated onsite and is relatively safe to operate.*

References

Alliance for the Great Lakes: *Protecting Lake Michigan by Protecting the Chicago River Waterway System*, (Chicago, 2005).

Bellar T.A., J.J. Lichtenberg, and A .D. Kroner, 1974: *The Occurrence of Organohalides in Chlorinated Drinking Water*. J. AWWA 66: 703.

Chicago Public Library website archives: *1900 Flow of Chicago River Reversed*. [Available at: http://www.chipublib.org/004chicago/timeline/riverflow.html A Chronological History of Chicago: 1673-]. (Compiled by Chicago Municipal Reference Library, City of Chicago. Updated by Municipal Reference Collection, Jekel, M.R., Roberts, P.V., 1980: *Total Organic Halogen as a Parameter for the Characterization of Reclaimed Waters: Measurement, Occurrence, Formation, and Removal*. Environmental Science and Technology, 14(8), 970-975.

Johnson J. D., R.F. Christman, D.L. Norwood, D.S. Millington, 1981: *Reaction Products of Aquatic Humic Substances with Chlorine*. Presented at international symposium on the health effects of drinking water disinfectants and disinfection by-products, Cincinnati.

Kransner, S.W. et al, 1989: *Occurrence of Disinfection By-products in US Drinking Waters*. J. AWWA 81 :8:40.

Mayor Richard Daley's "Chicago River Agenda" – Chicago, June 2005

Metropolitan Water Reclamation District of Greater Chicago website: www.mwrd.org.

Minnesota Pollution Control Agency website. *Glossary*. [Available at: http://www.pca.state.mn.us/gloss/glossary.cfm?alpha=E&header=1&glossaryCat=0].

Murray, C., Sohngen, B.: *Valuing Water Quality Advisories at Lakes*, (Ohio State University, May 2000).

Murray, Sohngen and Pendleton. 2001. *Valuing Water Quality Advisories and Beach Amenities in the Great Lakes.* Water Resources Research. Vol. 37 No. 10; pgs. 2583-2590. October 2001.

MWRD Report No. 2006-38: *Expert Review Report Regarding United State's Environmental Protection Agency's Water Quality Criteria for Bacteria – 1986: Application to Secondary Contact Recreation* – July 2006.

MWRD Transmittal Letter For Board Meeting of June 17, 2004: *Agenda Summary: Report on the Use Attainability Analysis (UAA) Study for the Chicago Area Waterways (CAWs)*. Committee on Research and Development. (June 4, 2004).

MWRDGC Position on Proposed Use Classifications and Water Quality Standards (from March 22 IEPA Stakeholder Advisory Committee Meeting, Chicago, IL).

http://ohioline.osu.edu/b873/b873_8.html].

USEPA, 1997: